Technology Opportunity

Industrial, Medical and Art Restoration Applications of Surface Texturing

The National Aeronautics and Space Administration (NASA) seeks to transfer technologies that can produce surface textures which enhance heat transfer, cell attachment, and other surface properties, as well as provide surface cleaning for delicate objects.

Potential Commercial Uses

- Medical
  - Increased cellular attachment to implants
  - Cellular stimulation
  - Improved fixation of orthopaedic implants
  - Uniform fiber optic illumination for photodynamic therapy
- Industrial
  - Improve polymer handling
  - Alter wetability
  - Reduce or increase friction
  - Increase diffusivity of transmitted light
  - Reduce glare from surfaces
  - Increase heat transfer from radiator surfaces
  - Improve adhesive bonding
  - Improve paintability
  - Enhance catalytic surfaces
- Art Restoration and Cleaning
  - Removal of soot
  - Removal of varnishes, including urethanes
  - Removal of organic contaminants

Benefits

- Can improve radiative heat transfer by a factor of 8 to 10
- Requires no physical contact with the surface
- Allows precise control of exposure
- Can be scaled-up to meet most processing needs

The Technology

Technology developed for space propulsion and simulation of the space environment has made it possible to alter the surface of many materials through texturing (see fig. 1). Surface texturing can improve

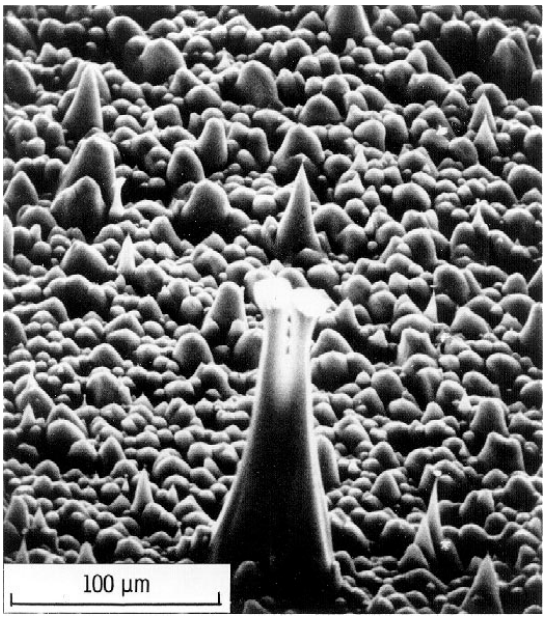

Figure 1.—Scanning electron photomicrograph of sputter-etched FEP Teflon® surface with two dust particles on the initial surface.

the fixation of orthopaedic implants and increase cellular attachment, make transmitted light more diffuse, reduce surface glare, change friction and wetability of a surface, improve heat transfer, and produce many other beneficial effects. Some of the same technology can be used to remove thin organic coatings, such as adhesives, varnish, and soot, from surfaces. The process involves no physical contact with the surface, which makes it attractive for cleaning delicate art objects.

Surface texturing can be produced by a variety of techniques; the simplest technique for metal surfaces is arc texturing. This involves producing a

low-voltage, moderate-current arc between the surface and an electrode composed of either carbon or silicon carbide. The arc produces pits in the surface and deposits some of the carbon from the electrode, which also enhances the surface roughness. Finer textures can be produced either by bombarding the surface with a high-energy beam of inert gas ions through a mask, with simultaneous arrival of masking atoms from another source, or by allowing the surface to develop a natural texture. Very fine surface texturing of organic surfaces or removal of organic layers can be accomplished with a low-energy beam of oxygen atoms. The oxygen atoms chemically react with the organic surface (layer) and convert it predominantly to carbon monoxide and carbon dioxide. The resulting organic surface develops a natural texture. If the organic layer is on paint or another surface that is less reactive, the organic layer can be preferentially removed. All of these technologies are developed to the point of being scaled-up for industry use.

Options for Commercialization

One of NASA's missions is to commercialize its technology. The Electro-Physics Branch at NASA Glenn Research Center currently works with many companies through a Surface Coating and Texturing Consortia with the Great Lakes Regional Technology Transfer Center (GLITeC). Alternatively, we can work through individual task orders to tailor texturing technologies to specific commercial needs and to assist customers with scale-up of the technology. Patents have been granted for Arc Texturing, Ion Beam Sputter Etching, and the Atomic Oxygen Process for Art Restoration. If your company is interested in licensing these technologies or is in need of assistance to develop one of these technologies, please contact us.

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References

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